Electronic Version
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Claims

[c1] 1.An electrostatic discharge device comprising:
a forward biased trigger device fabricated in a given technology;
a clamp transistor coupled to the trigger device so that activation of the trigger device activates the clamp transistor, the clamp transistor having a cutoff frequency which determines its Johnson Limit breakdown voltage;
the trigger device being fabricated in the given technology and having a trigger activation voltage above which the trigger device activates the clamp transistor, with the trigger activation voltage being below the Johnson Limit breakdown voltage of the highest frequency device fabricated in the given technology.

[c2] 2.The electrostatic discharge device of claim 1, wherein the trigger device is coupled to the base of the clamp transistor.

[c3] 3.The electrostatic discharge device of claim 1, wherein the trigger device is constructed of a silicon germanium material.

[c4] 4.The electrostatic discharge device of claim 1, wherein

the clamp transistor is constructed of a silicon germanium material.

[c5] 5.The electrostatic discharge device of claim 1, wherein the trigger device and the clamp transistor are coupled between an input pad and a ground.

[c6] 6.The electrostatic discharge device of claim 1, wherein the trigger device and the clamp transistor are coupled between a power rail and a ground rail.

[c7] 7.The electrostatic discharge device of claim 1, wherein the trigger device and the clamp transistor are coupled between a first power source and a second power source.

[c8] 8.The electrostatic discharge device of claim 1, wherein the trigger device is constructed of a plurality of trigger elements in a series configuration.

[c9] 9.The electrostatic discharge device of claim 1, wherein the trigger device includes at least one forward biased junction element in the group consisting of Si, SiGe and SiGeC.

[c10] 10. The electrostatic discharge device of claim 1, wherein the trigger device includes at least one forward biased junction element in the group consisting of CMOS

diodes, BiCMOS diodes, RF CMOS diodes, bipolar devices including Si, SiGe and SiGeC diode configured bipolar transistors and varactors, Schottky diodes in Si, SiGe and SiGeC, and MOSFETs.

[c11] 11.A method of fabricating electrostatic discharge protection in an integrated circuit comprising the steps of:
fabricating a forward biased trigger device in a given technology in the integrated circuit;
fabricating a clamp transistor coupled to the trigger device in the integrated circuit so that activation of the trigger device activates the clamp transistor, the clamp transistor having a cutoff frequency which determines its Johnson Limit breakdown voltage;
fabricating the trigger device in the given technology to have a trigger activation voltage above which the trigger device activates the clamp transistor, with the trigger activation voltage being below the Johnson Limit breakdown voltage of the highest frequency device fabricated in the given technology.

[c12] 12.The method of claim 11, including fabricating the trigger device and the clamp transistor of a silicon germanium material.

[c13] 13.The method of claim 11, including coupling the trigger device and the clamp transistor between an input

pad and a ground.

[c14] 14.The method of claim 11, including coupling the trigger device and the clamp transistor between a power source and a ground.

[c15] 15.The method of claim 11, including fabricating the trigger device as at least one forward biased junction element in the group consisting of Si, SiGe and SiGeC.

[c16] 16.The method of claim 11, including fabricating the trigger device as at least one forward biased junction element in the group consisting of CMOS diodes, BiCMOS diodes, RF CMOS diodes, bipolar devices including Si, SiGe and SiGeC diode configured bipolar transistors and varactors, Schottky diodes in Si, SiGe and SiGeC, and MOSFETs.

[c17] 17.A semiconductor device comprising:
a first rail for providing a first voltage source;
a second rail for providing a second voltage source;
functional circuitry, coupled between the first and second rails, for performing an electrical function;
electrostatic discharge circuitry, coupled between the first and second rails, for diverting electrostatic discharges from the functional circuitry onto either the first or second rail, the electrostatic discharge circuitry in-

cluding:

a forward biased trigger device fabricated in a given technology;

a clamp transistor coupled to the trigger device so that activation of the trigger device activates the clamp transistor, the clamp transistor having a cutoff frequency which determines its Johnson Limit breakdown voltage; the trigger device having a trigger activation voltage above which the trigger device activates the clamp transistor, with the trigger activation voltage being below the Johnson Limit breakdown voltage of the highest frequency device fabricated in the given technology.

[c18] 18. The semiconductor device of claim 17, wherein the first device and transistor are constructed of a silicon germanium material.

[c19] 19. The semiconductor device of claim 17, wherein the trigger device includes at least one forward biased junction element in the group consisting of Si, SiGe and SiGeC.

[c20] 20. The semiconductor device of claim 17, wherein the trigger device includes at least one forward biased junction element in the group consisting of CMOS diodes, BiCMOS diodes, RF CMOS diodes, bipolar devices including Si, SiGe and SiGeC diode configured bipolar transis-

tors and varactors, Schottky diodes in Si, SiGe and SiGeC, and MOSFETs.

[c21] 21. An integrated circuit comprising:
first rail for providing a first voltage source;
a second rail for providing a second voltage source;
functional circuitry, coupled between the first and second rails, for performing a desired function;
electrostatic discharge circuitry, coupled between the first and second rails, for diverting electrostatic discharges from the functional circuitry onto either the first or second rail, the electrostatic discharge circuitry including:
a forward biased trigger device fabricated in a given technology;
a clamp transistor coupled to the trigger device so that activation of the trigger device activates the clamp transistor, the clamp transistor having a cutoff frequency which determines its Johnson Limit breakdown voltage;
the trigger device having a trigger activation voltage above which the trigger device activates the clamp transistor, with the trigger activation voltage being below the Johnson Limit breakdown voltage of the highest frequency device fabricated in the given technology

[c22] 22. The integrated circuit of claim 21, wherein the trigger device includes at least one forward biased junction

element in the group consisting of Si, SiGe and SiGeC.

[c23] 23. The semiconductor device of claim 21, wherein the trigger device includes at least one forward biased junction element in the group consisting of CMOS diodes, BiCMOS diodes, RF CMOS diodes, bipolar devices including Si, SiGe and SiGeC diode configured bipolar transistors and varactors, Schottky diodes in Si, SiGe and SiGeC, and MOSFETs.